

Claims

- [c1] 1. A method of forming a bond microstructure, comprising:
sequentially forming a tin layer and a gold layer on one of two members, a % weight ratio of tin to gold being 20:80 having a variation range of about $\pm 3\text{--}4\%$; and treating the tin layer and the gold layer with a first temperature or a second temperature to form bond microstructures having different characteristics, wherein when the tin layer and the gold layer are treated with the first temperature, the bond microstructure will have a layered structure and when the tin layer and the gold layer are treated with the second temperature, the bond microstructure will have an eutectic structure.
- [c2] 2. The method of claim 1, wherein the first temperature is no more than 280°C.
- [c3] 3. The method of claim 1, wherein the bond microstructure having the layered structure comprises an AuSn layer and an Au_5Sn layer.
- [c4] 4. The method of claim 1, wherein the second temperature is higher than 280°C.

- [c5] 5. The method of claim 1, wherein the bond microstructure having the eutectic structure comprises AuSn and $\text{Au}_{\frac{1}{5}}\text{Sn}$.
- [c6] 6. The method for controlling a bond microstructure of claim 1, wherein the step of treating the tin layer and the gold layer with the first temperature or the second temperature comprises heating under pressure or a reflowing method.
- [c7] 7. The method of claim 1, wherein the gold layer is formed over the tin layer.
- [c8] 8. The method of claim 1, wherein the tin layer is formed over the gold layer.
- [c9] 9. The method of claim 1, wherein the tin layer is formed by performing an electroplating process, an evaporation process, an electroless plating or a sputtering process.
- [c10] 10. The method of claim 1, further comprising forming an adhesion layer, a barrier layer and a wetting layer on one or both of the two members before forming the tin layer and the gold layer on one of the two members.
- [c11] 11. The method of claim 10, wherein the adhesion layer comprises titanium or chromium.

- [c12] 12. The method of claim 10, wherein the barrier layer comprises Co, Ni, Pt or Pd.
- [c13] 13. The method of claim 10, wherein the wetting layer comprises Au or Cu.
- [c14] 14. The method of claim 1, wherein the two members comprise a flip chip and a substrate.
- [c15] 15. The method of claim 1, wherein the two members comprise a photo-electronic device and a substrate.
- [c16] 16. A method of forming a bond microstructure, comprising:
sequentially forming a tin layer and a gold layer on two members respectively, the % weight ratio of tin to gold being 20:80 having a variation range about $\pm 3\text{--}4\%$; and treating the tin layer and the gold layer with a first temperature or a second temperature to form bond microstructures having different characteristics, wherein when the tin layer and the gold layer are treated with the first temperature, the bond microstructure will have a layered structure and when the tin layer and the gold layer are treated with the second temperature, the bond microstructure will have an eutectic structure.
- [c17] 17. The method of claim 16, wherein the first temperature is no more than 280°C.

- [c18] 18. The method of claim 16, wherein the bond microstructure having the layered structure comprises an AuSn layer and an $\text{Au}_{\frac{1}{5}}\text{Sn}$ layer.
- [c19] 19. The method for controlling a bond microstructure of claim 16, wherein the second temperature is higher than 280°C.
- [c20] 20. The method for controlling a bond microstructure of claim 16, wherein the bond microstructure having the eutectic structure comprises AuSn and $\text{Au}_{\frac{1}{5}}\text{Sn}$.
- [c21] 21. The method of claim 16, wherein the step of treating the tin layer and the gold layer with the first temperature of the second temperature comprises heating under pressure or a reflowing method.
- [c22] 22. The method of claim 16, wherein the tin layer is formed by performing an electroplating process, an evaporation process, an electroless platingprocess or a sputtering process.
- [c23] 23. The method of claim 16, further comprising forming an adhesion layer, a barrier layer and a wetting layer on one or both of the two members before forming the tin layer and the gold layer on the two members.
- [c24] 24. The method of claim 23, wherein the adhesion layer

comprises titanium or chromium.

- [c25] 25. The method of claim 23, wherein the barrier layer comprises Co, Ni, Pt or Pd.
- [c26] 26. The method of claim 23, wherein the wetting layer comprises Au or Cu.
- [c27] 27. The method of claim 16, wherein the two members comprise a flip chip and a substrate.
- [c28] 28. The method of claim 16, wherein the two members comprise a photo-electronic device and a substrate.